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INTERNATIONAL POPLAR COMMISSION

Working Party on Diseases

Third Session

(Vienna, 10 September 1961)

REPORT

The Working Party met at the Hochschule für Bodenkultur in Vienna, under the chairmanship of Dr. H. van Vloten. The list of participants is given in Annex 1.

After approval of the agenda (Annex 2), the Working Party considered the following items :

1. Bark diseases in relation to relative turgidity of the bark

Professor Bier gave a summary of "An Application of the Clinical Approach for expressing the Degree of Tree Vigor and Vulnerability to Disease" (see Annex 3). It was considered possible that this approach would have a wider application than to fungal bark diseases; there might be a correlation between turgidity of the leaves and their susceptibility to foliar diseases. Professor Bier emphasizes that in addition the production of antibiotic micro-organisms seems to increase with turgor. The Working Party felt that institutes should take this method into due account in their research - this was already planned in different countries - and that advantage should be taken of Professor Bier's offer of making the relevant determinations on material sent to him. The turgidity should be determined during the dormant period of the tree.

2. Dothichiza populea

The report established on the basis of replies to questionnaires (FAO/CIP/100, Annex 7b, 1959) had been circulated to the national commissions, and some comments had been received. A complex of site conditions determines the damage by Dothichiza, and these conditions differ considerably in the different countries. In some countries, e.g. Germany, the Netherlands, and Yugoslavia, the disease now appears to be of somewhat lesser importance than some years back, partly due to better choice of planting site and improved cultural techniques.

The Working Party decided that the report should be distributed to the National Poplar Commissions. These Commissions will have to revise the report in order to meet their own special conditions, and provide for translation in their own language.

With regard to the question of standardization of testing methods for resistance to Dothichiza, some countries, e.g. Austria, are carrying out systematic resistance tests (see Annex 4). However, most members of the Working Party were of the opinion that for their conditions it is hardly justified to spend too much time and money on large-scale resistance tests. They are convinced that Dothichiza can be largely avoided through suitable choice of site and of planting stock, and good cultural techniques. Other members pointed out that the disease is of no importance in their countries.

The Working Party concluded that resistance tests are not necessary in all countries, and that each country should decide if such tests are required under the prevailing conditions. Research workers in charge of this testing should keep contact concerning the methods applied.

3. Trunk scab disease - Maladie dite des taches brunes

On the occasion of a meeting of the Biology Committee of the German Poplar Commission, some members of the Working Party met in Stuttgart on 8 June 1961 for an exchange of views on the disease (see Annex 5). The Working Party noted that a causal micro-organism was not determined up till now, that external factors, e.g. site and spacing, appear to be of decisive importance. A similar disease occurs on beech and other broadleaved species.

A program of work had been proposed at the Stuttgart meeting (see pages 6 and 7 of Annex 5). The Working Party decided that countries should be asked to give the information outlined on page 7 of Annex 5, with the addition of information on time and extent of the occurrence of attacks, and their economic importance. The collection of this information, together with the work envisaged by individual researchers (cfr. page 6 of Annex 5), constituted a minimum program under this heading.

4. Melampsora, Marssonina, Virus

(a) Practical importance; report of experiences

Melampsora rust is very important in some countries, especially in the Netherlands. Here heavy damage is done by M. larici-populina, since planting of larch has been extended considerably during the last decades also near to poplar plantations. The rust itself causes severe losses in increment, followed by heavy attack by Dothichiza in plantations of all age classes. The intensity of the disease is lessened by an increase of the potassium content of the poplar leaves. It is under consideration to prohibit larch in certain poplar regions in the Netherlands. In nurseries, chemical control is possible.

Also other countries report the occurrence of different Melampsora species, being more or less important. It is known, e.g., that poplar growing met severe difficulties in Argentina. Information has been added that M. pinitorqua, up till now known in Europe only, has been found in Canada recently. Research on Melampsora rust is in progress in different countries.

Marssonina is reported to have no economic consequences in some areas (Germany, Austria, United Kingdom), while it occurs rather extensively in others (Canada, Japan) and causes considerable damage in the Netherlands on trees of different ages. This damage is of the same type as that caused by Melampsora. It does not appear to attack the section Leuce. In the U.S.A., it attacks some hybrids, but not native poplars.

Virus disease (or diseases) of poplars are either unknown or of little consequence in several countries (U.S.A., Canada, Austria, etc.). In Germany and the Netherlands, studies are under way by means of electronic microscopes. Japan reported that the symptoms were differing and that there might be several diseases caused by agents of this group. Precautionary measures were being taken in the Netherlands. Here the virus has been artificially transmitted to herbaceous hosts (cfr. Annex 6), while research is going on concerning its practical importance.

(b) Resistance and susceptibility; testing methods

With regard to these agents, too high a degree of centralization of testing for resistance might easily lead to results not being valid in other areas, the species and external conditions being different in different regions. The species must be known before testing methods can be standardized. Resistance must be tested in several countries, including, e.g., Latin America.

Testing many poplar clones for their resistance to Melampsora larici-populina is done since some years in the Netherlands; a modification of Schreiner's method of rating is applied for assessment. Testing poplar clones on their susceptibility for Marssonina meets with difficulties in the Netherlands, because two species of Marssonina do exist there.

The Working Party concluded that the scale and the method of testing would have to be left to the countries, since it is necessary to take into account the importance of the problem in the individual countries and the methods already in use. A change in methods might destroy the utility of series of experiments, and it was considered more advantageous to await the results of the different methods being used.

It should be kept in mind further that it is not always safe to judge from laboratory tests to field conditions.

Any "declaration" or "certificate" of resistance presupposes trial in several countries.

Institutes were invited to cooperate mutually on assessment standards, such as is being done, e.g., between the United Kingdom and the Netherlands with regard to the bacterial canker.

5. Phytosanitary Regulations

This item was included in the agenda in order to bring the members of the Working Party up-to-date with regard to certain actions under way which were of interest to the Working Party. Mr. M. Andersen (FAO) reported that the European Forestry Commission of FAO, at its 1959 session, had requested FAO to study the matter of a harmonization of the phytosanitary regulations, of interest to forestry, presently in force. At the same time, it was known that the Organization for European Economic Cooperation (OEEC) had undertaken an enquiry in the matter. The Forestry and Forest Products Division of FAO, therefore, established the necessary contacts with the OEEC, obtained the result of their enquiry, and circulated this to the Forest Services of Europe and the Mediterranean region, requesting information on a number of specific points. FAO had also requested that the European and Mediterranean Plant Protection Organization (EPPO) take the matter up as a specific item of work of the standing Working Party on Phytosanitary Regulations, of the Organization. The material collected by FAO was placed at the disposal of EPPO, and FAO also arranged for EPPO the cooperation of several leading specialists in forest protection matters. Consultation with these specialists was carried out by EPPO first by correspondence and then at a meeting held in Vienna on 9 September 1961, the day preceding the meeting to which the present report refers. Subject to approval by the EPPO Working Party on Phytosanitary Regulations at their forthcoming meeting in November 1961, it seemed that the following points would be incorporated in recommendations to the Governments concerned :

(a) In the regulations, phytosanitary aspects should be kept clearly apart from others (such as provenance, genetical desirability, etc., an exception being resistance to pests and diseases).

(b) The FAO Certificate should be used and recognized, without additional declarations.

(c) Close cooperation between the Plant Protection Services and the Forest Services is a necessity and should be established in all countries.

(d) Risks are limited within Europe, but considerable with imports from overseas; rather comprehensive embargos should be envisaged in respect of the latter.

(e) Inspection and other control measures are of importance primarily in the exporting country, and they should cover a sufficiently long period.

(f) Post-entry quarantine measures are possible only for small consignments of plants, and inspection on arrival is generally of little value, or alternatively may damage the consignment; risks depend also on the quantity of the consignment.

(g) Because of the climatic and ecological differences in Europe, a unification of the lists of "quarantine" pests and diseases and of prohibited or restricted host plants can only be set up regionally or through bilateral agreement.

With regard to timber :

(h) Imports (and perhaps transit) of unbarked timber, especially from overseas, should be prevented to the extent practicable. Barked timber and milled products do not normally carry risks of economic consequence.

With regard to seed :

(i) This is a question of treatment and inspection. Risks are limited within Europe, greater with import from overseas.

The meeting requested that one of the forest protection specialists and a representative of the FAO Forestry Division attend the meeting in Paris on 15 November 1961.

6. Journal de Liaison

This information bulletin has now been sent out in two issues, one in July 1960 and one in January 1961. The members of the Working Party have expressed a definite interest in this means of keeping in contact. The Working Party requested its members to send their contributions for the next issue to Mr. Taris in time (before 1 January 1962), and commended his work in this connection.

7. Date and place of the next Session

Being informed that the International Poplar Commission was scheduled to meet in Yugoslavia in September 1962, the Working Party agreed that its Fourth Session should be held on that occasion. This, of course, would not prevent any groupings of the Working Party from meeting at an earlier date should need and occasion arise.

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ANNEX 1

LIST OF PARTICIPANTS

Chairman	:	H. van Vloten (Netherlands)
Vice-Chairman	:	H. Zycha (Germany)
Secretary	:	M. Andersen (FAO)

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M. Androić (Yugoslavia)
J. E. Bier (Canada)
I. N. Costantino (Argentina)
E. Donaubauer (Austria)
J. R. Hansbrough (U.S.A.)
R. Imazeki (Japan)
M. Jacamon (France)
A. Métro (FAO)
V. J. Nordin (Canada)
T. R. Peace (United Kingdom)
M. Ridé (France)
H. A. van der Meiden (Netherlands)
W. Wettstein (Austria)

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ANNEX 2

A G E N D A

1. Opening.

2. Adoption of the Agenda.

3. Bark diseases in relation to relative turgidity of the bark (research by Professor Dr. Bier, Vancouver, D.C.).

4. Cryptodiaporthe (= Dothichiza) populea.

   (a) Final report based on questionnaire.
   (b) Standardization of testing methods for resistance.

5. Trunk scab disease - report by the group of specialists' meeting, Stuttgart, 1961.

6. Melampsora, Marssonina, Virus.

   (a) Practical importance; report of experiences.
   (b) Resistance and susceptibility; testing methods.

7. Phytosanitary Regulations.

8. Other questions.

9. Date and place of the next Session.

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ANNEX 3

AN APPLICATION OF THE CLINICAL APPROACH FOR EXPRESSING THE DEGREE OF TREE VIGOR AND VULNERABILITY TO DISEASE

(Information to supplement a Paper presented to the Working Party on Diseases, of the International Poplar Commission, Vienna, 1961.)

A. HYPOTHESIS

Forest, Plantation, or Individual Tree Problem

(related to growth, degree of vigor, and vulnerability to disease)

Empirical Approach	Clinical Approach
Initially, attempts are made to relate the problem to one or more of the many and complex soil and/or climatic factors.	Initially, the problem is related to one or more anatomical or physiological indices within the trees, which will serve as a direct expression of the interaction of all soil and climatic factors.
Frequently results expressed in a number of multiple correlations difficult to assess or define, and generally restricted in application to similar areas within the region sampled.	With a reliable index it has not been difficult to determine the climatic or soil factors which are affecting adversely tree vigor and disease resistance. Within a tree species the index may be applied internationally.

Justification and Basis for Bark Turgor Level as an Index of the Degree of Tree Vigor and Vulnerability to Canker Diseases (Facultative Parasites).

1. One conclusion that appears in common in many studies related to climate, soils, site quality, and vulnerability to pest attack is that the areas supporting the poorer trees have lesser amounts of available soil moisture. Within a tree species the amount of water in tissues containing the largest proportion of living, functional cells (foliage and young bark) may also vary in accordance with site quality, disease vulnerability, etc. Therefore, the moisture content of living cells in a tree may provide a physiological index for degree of vigor.

2. The most reliable method of expressing the water content in living cells is on the basis of turgor level. The turgor level is higher in vigorous cells, since they contain larger amounts of food substances and other materials which absorb and retain water.

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3. The activity and turgor level of functional, living cells varies depending upon :

(a) trees in growth - cells very active - high turgor level;
(b) trees in dormancy - cells relatively inactive - lower turgor level.

Experience has shown that the living cells in the foliage and bark of trees with varying degrees of vigor maintain high turgor levels during the growing season. Turgor level has not provided a good index of tree vigor when the measurements were made during this period. However, during dormancy significant and consistent differences in turgor level are evident between vigorous and less vigorous trees, always considerably higher in vigorous trees. Therefore, the establishment of turgor level as an index for degree of vigor and disease vulnerability is dependent upon measurements made during the dormant period of the trees, when the natural defence mechanisms against all forms of injury are lessened or at a minimum.

4. The measurement of bark turgor was chosen since, in deciduous trees, material was available for study during all months of the year.

Determination of Bark Turgor Level.

Necessary to use young bark, preferably not more than 1-year-old.

Method:

(a) Cut out sample of bark to cambium (approx. 1 gm).
(b) Weigh the sample of bark (fresh wt.).
(c) Soak the bark sample for 24 hrs. in distilled water (saturated wt.).
(d) Blot off surface water and weigh the saturated sample.
(e) Oven dry the saturated sample (4 hrs. at 95°C.).
(f) Weigh the oven dry sample.
(g) Determine wt. of water in fresh sample.
(h) Determine wt. of water in saturated sample.

$$\text{Relative Turgidity \% of bark} = \frac{\text{wt. of water in fresh sample} \times 100}{\text{wt. of water in saturated sample.}}$$

(Same method may be used for foliage.)

Measurement of the Degree of Tree Vigor.

Bark turgor levels were correlated with the following criteria for expressing the degree of tree vigor :

(a) Vulnerability to canker diseases (facultative parasites).
(b) Ability of tree material to produce wound tissue.
(c) Rooting performance in cutting stock.

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B. EVIDENCE IN SUPPORT OF THE HYPOTHESIS.

1. Bier, J. E. 1959. The relation of bark moisture to the development of canker diseases caused by native, facultative parasites.

1. Cryptodiaporthe canker on willow. Can. J. Botany, 37, 229-238.

2. Bier, J. E. 1959. 2. Fusarium canker on black cottonwood. Can. J. Botany, 37, 781-788.

3. Bier, J. E. 1959. 3. Cephalosporium canker on western hemlock. Can. J. Botany, 37, 1140-1142.

4. Bier, J. E. 1961. 4. Pathogenicity studies of Cryptodiaporthe salicella (Fr.) Petrak, and Fusarium lateritium Nees., on Populus trichocarpa Torrey and Gray, P. 'robusta', P. tremuloides, Michx., and Salix sp. Can. J. Botany, 39, 139-144.

5. Bier, J. E. 1961. 5. Rooting behaviour and disease vulnerability in cuttings of Populus trichocarpa Torrey and Gray, and P. 'robusta'. Can. J. Botany, 39, 145-154.

6. Bier, J. E. 1961. 6. Pathogenicity studies of Hypoxylon pruinatum (Klotzsch) Cke., and Septoria musiva Pk. on species of Acer, Populus, and Salix. Can. J. Botany, 39, September Number.

7. Bier, J. E., and Marian H. Rowat. 1961. 7. Some effects of the saprophytic fungi on the bark of poplar and willow on the incidence of Hypoxylon canker. Submitted for publication in the Can. J. Botany.

The results of these studies which were conducted in the field and in the laboratory have demonstrated a close correlation between the development of bark cankers caused by facultative parasites and the relative turgidity level of young, living bark. The relative turgidity level served as an expression of the ability of theliving cells in the bark to absorb and retain water. High relative turgidity values during the dormant seasons when the natural defence mechanisms of the hosts were lessened, or at a minimum, indicated favorable levels of tree vigor and resistance to these canker diseases. The relative turgidity level of the dormant bark may be expected to vary in host material in accordance with differences in the growth characteristics which occur within a species, and between genera and species of trees. Canker growth occurred only when the relative turgidity of the bark was below 80%. Indeed, in cuttings of P. trichocarpa and P. 'robusta' the level of bark turgor proved to be a useful index of host vigor based on their rooting performance in addition to their vulnerability to canker diseases.

Further, it was demonstrated that the host ranges of the canker diseases investigated could be enlarged considerably when the pathogenicity tests were made on living host material that was allowed to dry gradually (lower turgor level) in a dormant condition.

The uniformity in the results of investigations with different pathogens on different genera and species of trees introduced the possibility that international cooperation for the screening of some canker diseases caused by facultative parasites may be accomplished by pathogenicity tests on dormant cuttings of the hosts, to establish the threshold levels of bark turgor which indicate disease susceptibility. After the threshold level has been determined for a host and pathogen, it may be possible to relate this value to the field behavior of the tree as it occurs in different countries. The assignment of disease vulnerability ratings to different stands and plantations of the host may be feasible. For example, the threshold levels of bark moisture for susceptibility to Hypoxylon canker were found to be very similar in P. tremuloides, P. trichocarpa, and Salix sp., the average relative turgidities varying from 75 to 77%. This also applied to Septoria canker, only in these instances the threshold levels for susceptibility were lowered to average relative turgidities between 69 and 71%. From these results it was concluded that H. pruinatum was the most virulent pathogen, since it attacked more vigorous bark as indicated by the higher values in bark moisture. Therefore, under field conditions it may be expected that Hypoxylon canker would occur in more vigorous trees or stands of these hosts than Septoria canker.

In the standard-sized cuttings of P. tremuloides, P. trichocarpa, and Salix sp., the losses in total weight were considerably greater at the time of canker development by S. musiva than by H. pruinatum. Therefore, the average weight of samples of dormant cuttings harvested from the previous season's growth and cut to a uniform size, may indicate the vigor level of the trees and their relative vulnerability to these canker diseases. The results supported previous studies which mentioned that a "hazard stick" technique might be developed in which an expression of the general vigor of dormant nursery stock or stored material could be obtained in the field by determining the average weight of cuttings of uniform size.

The information presented in the preceding paragraphs mentions two methods which may be considered in an International Program for the screening of some canker diseases caused by facultative parasites. Pathogenicity tests on dormant cutting stock harvested from the previous year's growth may be adequate for the establishment of threshold levels which indicate host susceptibility, and which are based upon bark turgor level and (or) average total weight of uniform-sized cuttings. These threshold levels could be related to the dormant field behavior of the host trees in different countries. Should these methods provide sound results, it is evident that the experimentation could be undertaken very inexpensively, and provide conclusive results within a short period of time. For example, an Italian forester may be interested in the risks

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involved through the accidental introduction of H. pruinatum and S. musiva into stands or plantations of a European poplar which has been widely planted in his country. In such an instance it would seem possible that certified, dormant cuttings with sealed ends could be placed in a plastic bag and shipped by air to a North American laboratory for investigation. Pathogenicity tests could be made in the laboratory for the purpose of establishing the threshold levels of bark turgor which indicate susceptibility to Hypoxylon and to Septoria canker. Past experience has indicated that this experimentation may be completed within a period of two months. Once established, these threshold levels could be related to the field behavior of the host trees in Italy and in other countries.

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and Botany, University
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Vancouver 8, British
Columbia, Canada.

2 August 1961.

ANNEX 4

REPORT FOR THE WORKING PARTY ON POPLAR DISEASES, OF THE INTERNATIONAL POPLAR COMMISSION

by

E. Donaubauer

As known to the I.P.C. from the last summary report of the Austrian National Poplar Commission (A.N.P.C.), a long-term program is under way within the frame of the Federal Experimental Station of Forestry, with the aim of submitting all of the poplar assortment of the above Station to an extensive early test. Testing the degree of susceptibility to disease of various poplar species and cultivars will fit into this program, relating chiefly to the economically most important poplar disease, provoked by Cryptodiaporthe (- Dochichiza) populea.

During 1960/61 inoculation tests were carried on with 29 different poplar test numbers. These tests were to furnish information on the following questions :

(1) Do the various test numbers show differences under equal site conditions, and can their significance be statistically proved?

(2) Do the inoculation tests furnish results coinciding with previous observations on natural infections?

(3) Is inoculation more favourable, from the viewpoint of experimental technique, through a lesion artificially applied or by contacts, and do the results of both these methods coincide?

(4) Influence of cutting thickness on the test result?

All of these questions are extensive and by no means to be cleared up perfectly by a single test, but yet some valuable hints could already be obtained :

Description of all details on the material and methods used may be reserved for the publication which is being prepared. Here I should like only to mention briefly that per test number and experimental design 10 (ten) cuttings were used which were taken from one rod each in a motherstock bed (length of cuttings 16 cm. - about 6 inches). The inoculated material was kept in air-conditioned boxes at + 10^{0}C. and 90 p.c. relative air moisture. Progress of infection was frequently measured. Infection took place either by cut wounds or by contact, in each case in immediate neighbourhood of a leaf scar or bud.

The following results may be rendered by catchwords :

(1) Statistical analysis (analysis of variance) has revealed that many of the test-numbers examined deviate with high or fair significance from the type average or from other types.

(2) As a general rule, the present study has given equal or similar results as have been obtained from the statistical analysis of natural infections in the field. . . .

Before drawing such parallels, however, one must decide what checking term one is willing to - and should - choose for this comparison from within the eighty days period of experiment. In fact, it has resulted that the order of types according to intensity of attack may shift considerably within the period of experiment. Thus, the question of fittest timing of the check is interesting for any future inoculation experiments. In the types T 1 - 5 (tee one to five) (Stout and Schreiner breedings) it has resulted that just the type which, according to the assessment of natural infection, had been considered most susceptible among the group, proved most resistant to artificial inoculation. Now, which of these results is the true one? In other cases, however, the sequence has kept constant and was confirmed more or less clearly.

As results from the experience outlined, a test with one concluding check only cannot give a true picture of type differences unless it is known what timing is the favourable one. For the present, therefore, it is preferred not to pick out a single checking date for rating (as it is the case if measurements are carried out e.g. only after conclusion of an experiment) but to use the whole course of experiment. Observation of natural infections will then constitute a necessary supplement for putting correctly into practice the results obtained.

(3) As to the question of a difference in the test result between wound and contact infection it has resulted that there was no uniform tendency: in fact, partly parallel results were obtained, partly the sequence has even turned to the contrary in that a type that had shown resistance in the wound infection test came out susceptible from the contact infection test.

All this reveals that our results still are affected with a lot of incertitude and that manifold experiments will be needed before a clear picture is obtained of resistance or susceptibility of individual types.

(4) A very clear interdependence was observed between susceptibility and thickness of cuttings: with a striking regularity resistance increased with increasing diameter of the cutting. The more was I struck with the fact that this regularity was interrupted once in each series, namely regularly just in the eighth or ninth cutting. Explanation of this phenomenon is still pending.

A note on the connection between rust attack and frost damage :

During spring 1960 frost damage had become apparent at Tulln Experimental Nursery of the Federal Experimental Station of Forestry, on several Italian and American poplar cultivars. Since previously a survey of differences in rust attack intensity had taken place at the same garden, there was offered an occasion of re-examining the often-heard opinion about a connection between frost and rust susceptibility.

Comparison of results has, however, shown no such connection. On the contrary, it must be stressed that cultivars more heavily attacked than others, at the same time, have suffered no frost damage whatever. If not even in a year of particular frost danger a connection with rust susceptibility has become apparent, serious doubts should be entertained as to the existence of such a connection.

ANNEX 5

INTERNATIONAL POPLAR COMMISSION

WORKING PARTY ON DISEASES

MEETING on TRUNK SCAB DISEASE

(Stuttgart-Weilimdorf, 8 June 1961)

Present : Messrs. H. van Vloten, Netherlands (Chairman)
H. F. Joachim, Eastern Germany
H. A. van der Meiden, Netherlands
A. Rambelli, Italy
M. Ride, France
O. Sebald, Federal Republic of Germany
(representing M. Schönhar)
H. Zycha, Federal Republic of Germany

(1) Opening of the Meeting

The Chairman reported the absence of :
Messrs. Taris, Secretary of the Working Party
Peace, United Kingdom
Schönhar, Federal Republic of Germany
Vivani, Italy
Krstić, Yugoslavia

Mr. PEACE had stated that the disease was not common in England.

Dr. VIVANI had offered to help in research work if necessary. Professor KRSTIĆ, though invited to the Meeting, had not replied; perhaps the wrong address had been given in the Newsletter?

(2) Agenda :

1. Approval of the Agenda.
2. Economic repercussions of the disease in the various member countries of the IPC.
3. Review of bibliographical data.
4. Program of work (to be discussed) and coordination of research.

Items 2 and 3 of the Agenda were reversed.

(3) Documents Review

The report written by Mr. OLDENKAMP, in collaboration with the Hardwood Silviculture Section of the Silviculture Experiment Center in Wageningen, was the basis for discussion.

(a) Susceptible species and clones

According to RAMBELLI, all clones of the Aigeiros group are susceptible to trunk scab disease. Last year, I. 214 was attacked both in nurseries and in two-year-old plantings. The susceptibility of the clones depends on external factors, especially on soil condition, and the degree of clone susceptibility can be reversed in some cases. RAMBELLI suggested that it would be interesting to know why poplars did not get the disease in England.

JOACHIM, on the basis of many observations in Bulgaria, Czechoslovakia, Hungary and Poland, on different clones, considered Brabantica and Marilandica more resistant and Robusta and P. berolinensis very susceptible. Poplars of the last-mentioned variety growing near Warsaw, however, were not attacked.

In the Netherlands, a varying degree of susceptibility was noted for different clones under widely differing conditions. Of the Aigeiros clones, Robusta, Gelrica and I. 488 were the most susceptible and Marilandica the least. No trunk scab had been found so far on P. berolinensis (van der MEIDEN).

SEBALD mentioned Robusta and P. berolinensis as being very susceptible.

RIDE reported that in France Robusta and I. 488 were the most susceptible. The extent of damage varied according to region and from one year to another. In the very special case of the Chautagne marshes, for 1959, the following classification in order of decreasing susceptibility could be made : Robusta, I. 488, I. 476, I. 92-40, I. 455, I. 214, I. 154, I. 262. The most resistant were Serotina de Poitou, P. deltoides angulata of Chautagne and P. deltoides missouriensis. In addition, RIDE reported that in Yugoslavia certain types of Serotina, P. alba and P. nigra were susceptible, while the disease had hardly any effect on Robusta (PENO, personal letter).

According to JOACHIM, Robusta had been noted as being very susceptible in Bulgaria and Hungary in 1956. The trend toward widely spaced plantations seemed to reduce the incidence of the disease.

(b) Symptoms

For a description of the symptoms, see the OLDENKAMP report.

Van VLOTEN pointed out the importance of using the correct name for the disease in order to avoid any misunderstanding.

RIDE remarked that in France, Germany and the Netherlands the same name was used, while in Czechoslovakia and Yugoslavia the disease was often called "canker" and in Italy "bacteriosis". This might lead to the disease being confused with bacterial canker, which has completely different symptoms.

International standardization of the name was desirable.

While the viscous and whitish exudation appearing in spring might be recognized as a characteristic of bacterial canker, the watery discharge (often released from the projecting pustules) was not typical of that disease.

According to RAMBELLI, the vesicles may form at any time during the year.

JOACHIM pointed out that the severity of the lesions from the vesicles varies greatly; he showed on diagrams that they may remain on the surface without reaching into the cambium, which therefore is not attacked in subsequent years, or the lesions may be deeper and penetrate into the cambium and spoil the quality of the wood.

Van VLOTEN called attention to the importance of internal symptoms which make it possible to detect the years and periods when the disease occurred.

JOACHIM, van der MEIDEN and RIDE pointed out that the first stage of the disease was very important. From his anatomical studies, JOACHIM concluded that traces of the disease were always noticeable first on the margin of two annual rings; a considerable length of time may elapse between this first stage and exudation.

ZYCHA found the same phenomena on anatomical sections of beech.

Van VLOTEN concluded that anatomical research should be continued.

No final opinion could be expressed with regard to the composition of the exudate. There was a discussion between RAMBELLI and RIDE on the possibility of autofermentation of the cellular contents of the cellulosic parenchyma.

(c) Influence of environmental factors

On the whole, the disease had not been reported in nurseries except in France in certain badly tended ones or those laid out on ground with a subsoil containing a high percentage of active lime; in a few places in Italy and in the Netherlands on two-year-old Gelrica varieties.

Spacing is very important. Van der MEIDEN noted this disease in the Netherlands in a region where Robusta and Marilandica planted on three very different types of soil were spaced 3 x 3, 3.5 x 3.5, 4 x 4, 5 x 5, 6 x 6 and 7 x 7. In every case, the Marilandica variety remained healthy. For Robusta, the disease increased in intensity inversely proportional to spacing. JOACHIM came to the same conclusion at Koltay in Hungary.

A discussion was started on the influence of the soil. RAMBELLI found that the nature of the subsoil had a decisive effect. Van der MEIDEN emphasized that all soil factors (chemical or physical) which hampered the water intake of the tree (as well as the type of soil profile and excessive moisture) increased susceptibility to the disease. RIDE pointed out that any sudden variation in the water level created conditions favorable for the disease.

JOACHIM commented at length on the influence of climate. In one particular case he found that trees were severely infested after the hard winter in 1956 as a result of the wide fluctuations in temperature, especially when they occurred at the time of renewed cambial activity at about six weeks before the first leaves appeared. From the physiological standpoint, damage by frost is the same as that caused by drought.

JOACHIM, van der MEIDEN, RIDE and SEBALD gave examples of increased damage occurring after dry summers.

JOACHIM did research on the sides of the trunk where scab disease occurred. Out of 332 cases studied, results clearly showed that the scabs were found chiefly on the south, southwest and west sides of the trunk.

The extent of direct damage caused by the sun's rays was also discussed. Although the disease may appear on all sides, it was generally recognized that the southern side was the most severely affected. Van der MEIDEN suggested that the thinness of the bark on the south side may be the reason.

The influence of crown development on the disease was mentioned by JOACHIM and van der MEIDEN, and for beech by ZYCHA. RAMBELLI wondered whether crown development was a primary factor. He thought that the ratio between crown and root development was important. JOACHIM, however, emphasized that root development depended on crown growth. In fact, he considered that dwarfing of the crown was an indication of increased susceptibility.

RAMBELLI, however, considered that it would be as well not to disregard the competition for nutrients (phosphates in particular) at root level.

(d) Cause

Although Dothichiza populea was sometimes found with trunk scab (SCHÖNHAR, TARIS, RIDE), this fungus did not generally seem to be considered as the primary cause of the disease. Its origin is more likely to be physiological. The pathological aspects, however, should also be examined.

(e) Damage on other species

Van der MEIDEN reported serious damage by trunk scab disease on red oak in the Netherlands; there was an abundant growth of epicormic

shoots on the tree and gradual withering of the crown. He also mentioned that a South African student in Wageningen had reported the presence of trunk scab on Acacia species, especially in dense plantations on dry sites.

ZYCHA described phenomena on beech and other hardwoods. The years when sudden fluctuations in temperature occurred at the end of winter and the beginning of spring were particularly dangerous. Beech, birch, alder and poplar showed similar symptoms. On birch an exudate sometimes appeared shortly after the onset of the disease. On beech the exudate may sometimes be present under the bark but cannot be detected from outside except when small cracks appeared in autumn.

RIDE showed photographs of the trunks of young birch on which the pustules exactly resembled those found on poplar. In fact, the anatomical reactions were the same. He emphasized that when a plantation of poplars infected with trunk scab disease included an understorey of willow and alder, the latter species often showed the same symptoms; when the poplars were healthy, the other two species were also. RAMBELLI found the disease on Salix alba and Alnus glutinosa. JOACHIM also saw pustules on birch. He reported that KALANDRA (Czechoslovakia) had found diseased birch in 1932 and in 1960 after a very dry summer but nothing between these two periods. In these cases, the birch trees showed vesicles as large as 25 cm. in diameter and many died. Later JOACHIM found the disease on Salix, Quercus rubra, Prunus avium, and Alnus glutinosa.

Although there was a striking similarity between the external symptoms of these different species, great care must be taken in determining their origin.

(4) Damage caused by trunk scab disease and its economic repercussions :

In the Netherlands, van der MEIDEN reported increasing losses in the match, veneering and sabot industries. It was thought that hail or small animals (squirrels) may help spread the disease.

JOACHIM, from experiments carried out in the paper-making industry, thought that trunk scab disease did not have any unfavorable impact on the quality of the pulp; the only effect was a slight brown coloring which disappeared on bleaching.

On the other hand, match manufacturers may reject as much as 60 percent of badly-diseased wood, especially of the Robusta variety.

According to ZYCHA, infected wood can be used in the paper industry. RAMBELLI also did not consider it unsuitable for the paper industry in Italy.

In France, no losses as far as industrial utilization is concerned were reported. RIDE mentioned that industrial users sometimes mistook the damage caused by Dendromyza carbonaria (cambium borer) for trunk scab.

This mistake was only liable to be made with the cross section of the wood, as the galleries tunnelled by this insect were easily recognizable in the longitudinal section.

Van der MEIDEN pointed out that the disease entailed losses both to industrial users and to producers. Regions where badly-diseased logs were sold were considered "contaminated" by the industry; this had an immediate effect on market prices for timber.

Van VLOTEN stressed the need for more complete information from the various countries on the economic significance of the disease.

(5) Program of work and coordination in research :

At the end of the Meeting, van der MEIDEN submitted a detailed plan of research (see appendix) which was approved in the main by the members of the Working Party. Everyone agreed that it was not desirable to confine oneself to the rigid outline of a questionnaire as descriptions should be as complete as possible.

The information yielded by cross sections appears to be particularly important as the wood-using industry could participate in research by supplying sections for examination, and diseased trees could be picked out in plantations and cut up for more detailed study.

JOACHIM said that he intended to pay more attention to the physiological aspect. He was going to verify water relations in the bark of still healthy three-year-old trees and would continue his observations when the first signs of the disease appeared.

In addition, RAMBELLI will apply the Bier method for observing water relations in the bark and will undertake mycological research. RIDE will continue bacteriological research, and ZYCHA will study the subject from the anatomical aspect.

/ APPENDIX

ANNEX 5 (continued)

APPENDIX

TRUNK SCAB DISEASE :

PROGRAM OF WORK FOR AN INVENTORY OF THIS DISEASE AND FOR EXAMINATION OF CROSS SECTIONS OF TREE TRUNKS

(1) Inventory :

The following data are important :

1. Clone.

2. Description of trees.
   - Habitat.
   - Color of the bark and condition of the rhytidome.
   - Extent of pruning; time of last pruning.

3. Description of plantation; in each case :
   - Type (row plantings, etc.).
   - Year of planting.
   - Spacing; average and minimum and maximum measurements for 20 trees.
   - Understorey.

4. Description of soil profile and water level during growth period. It is particularly important to note the depth of the humus layer and the different horizons with their granular structure.

5. Symptoms of the disease.
   - Description.
   - Degree of infection.
   - Period when pustules appear.
   - Position of the pustules and scars on trunk.
   - Course of the disease (in particular, whether or not the year's lesions become scars).
   - Effect of the disease on condition of trees.

(2) Examination of cross sections :

The following points should be written up :

1. Years during which the disease occurred.

2. Extent of infection for each year (number of scabs per year of growth).

3. If possible, origin of the trees, conditions under which they grew and the side of trunks on which the lesions occurred.

ANNEX 6

A VIRUS DISEASE OF POPLARS

During the last few years the Plant Protection Service of the Netherlands and the Netherlands General Inspection Board of Arboriculture (N.A.K.B.) have been paying much attention to a virus disease in poplars resembling "Canadian poplar mosaic" described by Atanasoff ('35) and "poplar mosaic" mentioned by Klinkowski ('58). The General Inspection Board of Arboriculture tries to eliminate this virus by certifying only unaffected trees and by destroying affected stocks.

The present investigations have been started to obtain some information about this virus.

At the beginning of the summer, i.e. June, light green star-like patches appear on the spring leaves progressing towards the autumn as far as the older summer leaves. Incidentally more seriously affected trees occur; in this stage the tree suffers visibly by the virus disease. Such trees show spots on the oldest as well as the youngest summer leaves.

From affected leaves a virus was sap-transmitted to some herbaceous hosts (Petunia hybrida and Vigna sinensis), which showed typical symptoms after a long incubation period.

Virus preparations observed by electron microscope revealed the presence of elongated particles. These uniform particles were found not only in partly purified virus from diseased poplar leaves but also in specimen prepared by the dip method (Brandes '57) from poplar as well as from Petunia and cowpea leaves infected by the virus.

Attempts to identify the virus among other methods with the help of serology are in progress. More extensive data will be published in due time.

This work is done for a doctor's thesis at the "Laboratorium voor Bloembollenonderzoek" at Lisse.

Ir. Th. M. BERG.

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